

## REMARKS

Claims 1-7, 10-19 and 21-23 are pending in the present application. Claims 8, 9 and 20 have been cancelled. Claims 1-2, 4, 10-12 and 21 have been amended. New Claims 22-23 have been added. Support for the amendments and new claims can be found throughout the specification, and in particular on pages 5-12 of the specification. Applicants respectfully request reconsideration of the present claims in view of the following remarks. The specification was amended to include the dimensions of some of the listed commercial fibers. These dimensions are inherent to the respective brand of fiber, as shown in attached Exhibits A and B, and thus do not introduce new matter.

### I. Formal Matters:

#### Rejection under 35 U.S.C. § 112, first paragraph

Claims 1-6, 10-12, 17-19 and 21 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter not described in the specification in such a way as to convey that Applicants had possession of the claimed invention. This rejection is respectfully traversed.

As was discussed in Applicants' previous response, lauryldimethyl amine oxide has more than one functional group. Applicants provided evidence of the cationic/nonionic nature of lauryl dimethylamine oxide by providing a copy of page 679 of The Handbook of Industrial Surfactants (previously submitted). As shown, lauryldimethylamine oxide is a known cationic/nonionic surfactant. As such, lauryldimethylamine oxide has both cationic and nonionic functional groups. The cationic functional group may react with anionic and other functional groups on the surface of a superabsorbent material. The nonionic functional group is non-reactive. As such, Applicants have provided evidence that lauryldimethylamine oxide has two functional groups. The Examiner responded by reiterating that lauryldimethylamine oxide has only one functional group. However, as was discussed, even if the chemical structure of lauryldimethylamine oxide is denoted as  $\text{CH}_3(\text{CH}_2)_{11}\text{N}(\text{CH}_3)_2\text{O}$ , this compound still contains two functional groups - an oxide group and an amine group. The oxide group is a hydrophilic, but non-reactive, functional group that is widely used as a hydrophilic functional group in the surfactant industry. The amine group is both reactive and hydrophilic. The amine group can react with a carboxylic acid, and when the amine is in the protonated state, carboxyl groups, both on the surface of the superabsorbent polymer. It is noted that anhydride groups on a polymer are hydrolyzed to form carboxyl groups and carboxylic acid groups before the polymer is spun into a fiber. In the present invention, the amine reacts with the functional groups at the surface of the

polymer, and the oxide remains at the surface of the treated polymer to enhance wettability by, for example, hydrogen bonding to polar molecules, such as water molecules. Therefore, since Applicants respectfully submit that lauryldimethyl amine oxide contains two hydrophilic functional groups: a positively charged amine group and a neutral/nonionic oxide group (-OR or -OH), and since the structure shown by American Chemical Society Registry RN #1604-20-5 supports the statement that lauryldimethyl amine oxide contains these two hydrophilic functional groups, then Applicants respectfully submit that this rejection be withdrawn. The structure provided by the Examiner agrees with the manner in which the manufacturer specified lauryldimethylamine oxide as a cationic/nonionic surfactant (reference was attached in a previous response). Again, Applicants wish to emphasize that a surfactant suitable for the application comprises at least one first functional group reactive with the second functional group of the superabsorbent material and at least one non-reactive and hydrophilic functional group (to enhance wettability). It is not necessary to have one cationic and one non-ionic group for this application. Any combination of cationic/non-ionic, cationic/anionic, cationic/non-ionic/anionic, cationic/anionic/cationic, cationic/non-ionic/cationic, etc., may be used as long as it meets the above specified requirement. Additionally, the information from what the Examiner referenced (Pines, p. 377 and American Chemical Society Registry RN #1604-20-5) supports Applicants' position. The structure of amine oxide on p. 377 shows two hydrophilic functional groups: a positively charged amine and a negatively charged oxide. If the Examiner submits that this structure represents lauryldimethyl amine oxide, then the Examiner has actually accepted the position that lauryldimethyl amine oxide has one positively charged amine and one negatively charged oxide group. This type of structured surfactant is also suitable in Applicants' claimed invention: the positively charged amine forms bond with negatively charged carboxyl groups on the superabsorbent polymer chain while the negatively charged oxide of the surfactant remains on the surface of the treated superabsorbent material to enhance wettability. As such, the negatively charged oxide is more hydrophilic than a neutral/non-charged -OR or -OH group. Accordingly, it is submitted that the amine oxide structure shown in Pines, p. 377 and American Chemical Society Registry RN #1604-20-5 contains more than one hydrophilic functional group.

Thus, it is respectfully submitted that Applicants did have possession of the claimed invention at the time the application was filed. Therefore, Applicants respectfully request the withdrawal of this rejection.

Rejection under 35 U.S.C. § 112, first paragraph

The Examiner rejected Claim 21 under 35 U.S.C. § 112, first paragraph, as lacking enablement for processes where the superabsorbent material is in a solvated state. This rejection is respectfully traversed.

Claim 21 has been amended as recommended by the Examiner. Accordingly, Applicants respectfully request the withdrawal of this rejection.

Rejection under 35 U.S.C. § 112, second paragraph

The Examiner rejected Claims 1-6, 10-12, 17-19 and 21 under 35 U.S.C. § 112, second paragraph, for failing to particularly point out and distinctively claim the subject matter which applicant regards as the invention. This rejection is respectfully traversed.

The Examiner rejected Claim 1, finding that the only identified surfactant in the specification did not meet the limitations of what was described as the surfactant in Claim 1. This is respectfully traversed. As described above, lauryldimethyl amine oxide has at least two functional groups that satisfy the claimed features of Claim 1. Accordingly, Applicants respectfully request the withdrawal of this rejection.

The Examiner rejected Claim 2 as indefinite, because it was unclear how much water was needed to solvate the surface. Claim 2 has been amended in line with the Examiner's suggestion. As such, Applicants respectfully request the withdrawal of this rejection. In regards to the Examiner's comments that the amendments to Claim 2 would not have overcome the other bases of rejection, it is respectfully submitted that as set forth in greater detail below, the floating time has been applied onto both superabsorbent particles ranging from 150 to 850 microns and commercial superabsorbent fibers with a diameter up to 50 microns. All commercial available superabsorbent materials are within these dimension ranges. Accordingly, Applicants have amended Claim 1 to define that "the superabsorbent material has a dimension that is less than about 1000 microns for particulate superabsorbents, or less than about 300 microns in diameter for fibrous superabsorbents".

The Examiner rejected Claims 10-12 as indefinite, for use of the following terms and related terms: "floating time" and "a reduction in surface tension of saline less than about 30%." The Examiner found that these phrases were indefinite because the saline was not defined and the conditions of the test were not specified. Claims 10-12 have been amended to recite that the superabsorbent material is a fiber. The saline is defined as 0.9% NaCl saline on pages 10-11

of the specification. Additionally, the conditions of the test are specified on pages 10-11 of the specification. Although Applicants have amended Claims 10-12, Applicants respectfully submit that their tests to determine floating time and surface tension were designed to cover a range of material dimensions. The floating time test was applied to superabsorbent particles having a dimension of 300-600  $\mu\text{m}$ , as opposed to fiber dimensions of around 20  $\mu\text{m}$ , and the test was still able to differentiate hydrophobic surfaces from hydrophilic surfaces. Applicants respectfully request the withdrawal of this rejection.

## II. Prior Art Rejections:

The Examiner rejected Claims 1, 4, 6, 10-12, 19 and 21 under 35 U.S.C. § 102 (b) as anticipated by, or in the alternative under 35 U.S.C. § 103 (a) as obvious over, U.S. Patent No. 3,989,586 to Bashaw et al. (hereafter "Bashaw"). This rejection is respectfully traversed.

Claim 1 is directed to a method of making a permanently wettable superabsorbent material, comprising treating the superabsorbent material with a surfactant solution and binding the surfactant to the surface of the superabsorbent material. The surfactant has at least one first functional group reactive with a second functional group of the superabsorbent material, and at least one non-reactive, hydrophilic functional group. The surfactant is applied to the superabsorbent material when the surface of the superabsorbent material is activated by increasing the amount of second functional groups available to react at the surface of the superabsorbent material. Applicants respectfully submit that Bashaw does not teach or suggest a method of making a permanently wettable superabsorbent material.

Bashaw does not teach or suggest the activation of the surface of a superabsorbent material to promote the chemical interactions between surfactant functional groups and functional groups on the surface of the superabsorbent material. Activation of the surface of a superabsorbent material increases the amount of functional groups at the surface available to form bonds with the reactive functional group of the surfactant. The surface of a commercial superabsorbent fiber is very hydrophobic, indicating there is almost no available functional groups available at the surface to react with the surfactant. Surface hydrophobization results when a drawn fiber is dried in hot air (see page 4 of the specification). An activation agent, such as a minor amount of water present in another solvent, is used to effectively achieve this surface activation. Bashaw teaches the pulverization of the copolymer in an attrition mill. Pulverization may produce new surface area, but it does not modify the old/previous surface. Pulverization does not result in the selective activation of functional groups on the surface of the copolymer as opposed to the interior of the polymer. Bashaw also teaches the coagulation of a

copolymer/acetone gel or copolymer/methylethyl ketone gel in methanol. Coagulation of these copolymer gels in methanol does not activate the surface of the copolymer with respect to the interior regions of the copolymer, since there is never a surface hydrophobization to begin with. Acetone, methylethyl ketone and methanol are hydrophilic solvents. Thus, during the formation of the copolymer and during its coagulation, both the interior and the surface of the copolymer are exposed to a hydrophilic environment. Coagulation in methanol does not increase the amount of hydrophilic functional groups at the surface with respect to the interior of the copolymer. Pulverization and coagulation are not activating processes. Moreover, these methods are not applicable to superabsorbent fibers because these methods would change/destroy the physical form of the fiber. Without surface activation, sufficient chemical binding between the surfactant functional groups and the surface functional groups on the superabsorbent material cannot be achieved. Without sufficient binding, a permanent wettable superabsorbent material cannot be achieved.

Applicants also submit that Bashaw fails to teach or suggest a permanently wettable superabsorbent material for the following reasons. Bashaw teaches that the copolymer is treated with an alkaline agent to convert the polymer into a water-swellaable salt form. This treatment would interfere with the ionic bounds formed between the surfactant functional groups and the surface functional groups on the superabsorbent material. For example, under alkaline conditions, protonated amine group of the surfactant ( $\text{NR}_3\text{H}^+$ ) is deprotonated to amine ( $\text{NR}_3$ ). Both ammonia and an alkali metal hydroxide will compete for hydronium ions, resulting in the displacement of ionic bonds formed by the surfactant. The deprotonation of the surfactant amine causes ionic bonds to disappear at the superabsorbent material surface, which in turn, causes the surfactant to become fugitive. Fugitive surfactant on the surface of a superabsorbent material dramatically reduces the surface tension of fluid that comes in contact with the superabsorbent material, and thus dramatically reduces the material's wettability and fluid wicking ability through the capillary channels due to low surface tension. Thus, the Bashaw reference teaches away from a method of forming a permanently wettable superabsorbent material. Moreover, Bashaw fails to teach or suggest the selective removal of fugitive surfactant from the surface of the superabsorbent material. Fugitive material will remain on the copolymer unless the copolymer is washed in a solvent that can dissolve the surfactant. Again, fugitive surfactant on the surface of a superabsorbent material dramatically reduces its wettability. Thus, Bashaw does not teach or suggest a method of forming permanently wettable superabsorbent material.

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In regards to these arguments, the Examiner alleges that pulverization and coagulation are activating processes and that Applicants' arguments to the contrary are not supported.

In response, Applicants agree that pulverization and coagulation processes may help the newly formed surface become more wettable as a result of these processes. However, these processes are not applicable for a superabsorbent material that has a surface that is already hydrophobic. Further pulverization on the superabsorbent material can create a new surface that may be hydrophilic, but the previous surface remains hydrophobic. This is also the case with regards to a coagulation process. The truth is that pulverization and coagulation processes cannot modify hydrophobic surfaces into hydrophilic surfaces. Without the presence of water to activate (or solvate since the only solvating agent for any superabsorbent materials is water), the existing hydrophobic surface will not be able to convert into a permanently wettable surface even if a suitable surfactant is used.

For at least the reasons given above, Applicants respectfully submit that Claim 1 is allowable over the art of record. Furthermore, since Claims 4, 6, 10-12, 19 and 21 recite additional claim features and depend from Claim 1, these claims are also allowable over the art of record. Accordingly, Applicants respectfully request the withdrawal of this rejection.

The Examiner rejected Claims 2-3, 5 and 17 under 35 U.S.C. § 103 (a) as unpatentable over Bashaw in view of U.S. Patent No. 5,223,026 to Schwarz, Jr. (hereafter "Schwarz, Jr."), as evidenced by the ACS Registry file. The Examiner found that Bashaw did not disclose the inclusion of an alcohol in the treatment with the surfactant, but that Schwarz, Jr. makes up for this deficiency by disclosing commercially available surfactants in alcohol solutions. This rejection is respectfully traversed.

Applicants respectfully submit that the combination of Bashaw and Schwarz, Jr. does not teach or suggest a method of making a permanently wettable superabsorbent material. Neither reference teaches or suggests the activation of the surface of the superabsorbent material. Moreover, neither reference teaches or suggests superabsorbent materials in which bound surfactant remains bound and fugitive surfactant is selectively removed. In Schwarz, Jr., the disclosure of surfactants sold in alcoholic solutions does not remove these deficiencies.

For at least the reasons given above, Applicants respectfully submit that Claim 1 is allowable over the art of record. Furthermore, since Claims 2-3, 5 and 17 recite additional claim features and depend directly or indirectly from Claim 1, these claims are also allowable over the art of record. Accordingly, Applicants respectfully request withdrawal of this rejection.

**II. Conclusion:**

For at least the reasons given above, Applicants submit that Claims 1-7, 10-19 and 21-23 define patentable subject matter. Accordingly, Applicants respectfully request allowance of these claims.

Should the Examiner believe that anything further is necessary in order to place the application in better condition for allowance, the Examiner is respectfully requested to contact Applicant's representative at the telephone number listed below.

No additional fees are believed due; however, the Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, to Deposit Account No. 11-0855.

Respectfully submitted,



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**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**Amendments in the Claims**

In accordance with 37 C.F.R. 1.121(c), the following versions of the specification and claims as rewritten by the foregoing amendments show all changes made relative to the previous version of the specification and claims.

**In the Specification:**

Please replace the paragraph beginning on page 6, line 16, and ending on page 6, line 21, with the following:

In one embodiment of the present invention, the absorbent fibers comprise one or more superabsorbent materials in the form of a sodium salt of a cross-linked polymer. Such superabsorbent materials include, but are not limited to, Fiberdri® 1161, Fiberdri® 1231, and Fiberdri® 1241 (all available from Camelot Superabsorbent Ltd. of Calgary, Canada); and Oasis® 101, Oasis® 102, and Oasis® 111 (all available from Technical Absorbents, UK). These fibers may have diameters around 20 microns and lengths ranging from around one centimeter to around five centimeters.

**In The Claims:**

Please cancel Claims 8, 9 and 20 without prejudice or disclaimer.

Please amend the claims as follows:

1. (Amended) A method of making a permanently wettable superabsorbent material, comprising:

treating the superabsorbent material with a surfactant solution ;

binding the surfactant to the surface of the superabsorbent material; and

wherein the surfactant has at least one first functional group reactive with a second functional group [of] on the surface of the superabsorbent material, and at least one non-reactive and hydrophilic functional group on the surface of the superabsorbent material; and

wherein the surfactant is applied to the superabsorbent material when [the second functional groups on] the surface of the superabsorbent material [are] is activated by increasing the amount of second functional groups available to react at the surface of the superabsorbent



material,

wherein the superabsorbent material has a dimension that is less than about 1000 microns for particulate superabsorbents, or less than about 300 microns in diameter for fibrous superabsorbents.

2. (Amended) The method of claim 1, wherein the surfactant solution includes a solvent that is a solvent to the surfactant but a non-solvent to the superabsorbent material; and

wherein the surfactant solution includes an amount of water sufficient to [solvate the surface of the superabsorbent material but less than sufficient to cause significant swelling of the superabsorbent material] activate the surface of the superabsorbent material to promote reaction between the first and the second functional groups on the surface of the superabsorbent material.

4. (Amended) The method of claim 1, further comprising washing the treated superabsorbent material with a solvent to selectively remove any fugitive surfactant.

10. (Amended) The method of claim 1, wherein the treated superabsorbent material is a fiber that has a floating time less than 30 seconds and causes a reduction in surface tension of saline less than about 30%.

11. (Amended) The method of claim 1, wherein the treated superabsorbent material is a fiber that causes a reduction in surface tension of saline less than about 25%.

12. (Amended) The method of claim 1, wherein the treated superabsorbent material is a fiber that causes a reduction in surface tension of saline less than about 20%.

21. (Amended) The method of claim 1, wherein the surfactant is applied to the superabsorbent material when the surface of the superabsorbent material is [in a solvated state] sufficiently solvated to promote reaction between the first and the second functional groups on the surface of the superabsorbent material.

New Claims 22 and 23 were added.